

and/or any other suitable contextual information. Example user behaviors include eating meals, showering, looking for lost objects, driving to work, and the like. By tracking and storing information related to such interactions over time, patterns of interaction with detected objects may be observed. For example, it may be observed via the see-through display device **100** that every afternoon at five o'clock a user sets down keys, and looks for the keys every morning at eight o'clock.

**[0025]** Alerts also may be generated based upon observed user patterns. For example, once a behavioral pattern related to user interactions with keys is recognized, a reminder regarding a location of the keys may be displayed automatically each morning at eight o'clock AM. Such patterns also may be used to formulate guesses as to where a lost object may be if the object has been moved since its location was last observed and stored via the see-through display device. An example of a displayed notice offering suggestions as to where to search for a lost object is shown in FIG. **2** in the form of a list **200** of locations at which to look for the object. FIG. **2** also shows a notice **202** regarding where the object was last seen. It will be understood that a notice regarding where to look for a lost object may take any form. For example, such a notice may take the form of graphical instructions that lead the user to the possible location(s), such as arrows and/or lines to follow, highlighting pointing out the suggested location to look, etc.

**[0026]** In some embodiments, a single view of a location may be generated based upon inputs of video data from multiple users, for example, where each user is uploading video data to a cloud-based service. This may allow objects seen in one user's video stream to be correlated with objects seen in another user's video stream, and therefore may allow objects to be tracked even when they are moved by other users. Further, object metadata may be shared across users so that multiple users can upload tracked object data instead of video data (e.g. such that multiple devices may perform local recognition for the same object).

**[0027]** As mentioned above, in addition to location, other states of objects may be understood and monitored. As non-limiting examples, a level of milk in a milk carton may be monitored. Likewise, a list of contents in a refrigerator may be monitored over time, and the absence of a item that is usually present may be noted. Based upon these observed states, alerts may be generated by a contextual trigger. For example, in the case of an observed empty milk carton, a visual overlay, an auto-generated shopping list, and/or a verbal reminder may be generated as the user walks by the milk section in the grocery store. The contextual trigger of being in the milk section of the grocery store may be understood in any suitable manner, including but not limited to by annotation or tagging of a particular type/brand of product by the grocery store or milk producer, by matching the appearance, size, and/or other physical and/or contextual characteristics of observed objects in the milk section with the characteristics of the tracked milk object, etc. Further, the fullness state of milk cartons may be adaptively learned as a tracked object state over time as the pattern of user shopping compared to the milk carton fullness state is observed over time (i.e. user consistently buys more milk when state of milk carton is empty or near empty).

**[0028]** FIG. **3** shows a block diagram of a use environment **300** for the automated tracking of inanimate moveable objects. The use environment **300** shows an arbitrary num-

ber **N** of object tracking devices, illustrated as object tracking device **1 302** and object tracking device **N 304**, in communication with a remote object tracking service **306** via a network **307**, such as a computer network. It will be understood that the object tracking devices may take any suitable form, including but not limited to the see-through display device **100** of FIG. **1**. It will further be appreciated that some embodiments may omit a remote object tracking service.

**[0029]** The object tracking device **302** comprises one or more sensors **308**. The sensors **308** may include image sensors, such as two-dimensional image sensor(s) **310** and/or depth sensor(s) **312**, which collect video data of a user's local environment. Any suitable type and number of two-dimensional image sensors **310** and/or depth sensors **312** may be included. Examples of suitable two-dimensional image sensors include RGB and grayscale sensors. Examples of suitable depth sensors include time-of-flight sensors, structured light sensors, and stereo depth sensors. It will be understood that any other suitable sensors may be included. Examples include, but are not limited to, microphones, global positioning system (GPS) sensors, motion sensors, inward-facing image sensors to detect eye motion, etc.

**[0030]** Image data collected via the image sensors is provided to an object recognition and tracking module **314**, which identifies objects imaged by the image sensors, and detects state information regarding the objects. The object recognition and tracking module **314** further may provide alerts to one or more outputs **316**, such as a display **318** (e.g. a see-through display, or any other suitable display) and/or one or more speakers **320**, based upon object state, as described in more detail below. The object recognition and tracking module **314** may identify objects in any suitable manner, including but not limited to via classification functions pre-trained by a developer, and/or classification functions trained by a user to recognize user-specified objects, wherein the classification functions compare and/or fit the observed objects to object models **315**. The object recognition and tracking module **314** may then output object identifications corresponding to the objects identified in the image data to an object information store **322**. Further, where new objects are detected (i.e. objects that have not been previously detected), the object recognition and tracking module **314** may assign identifications to the objects.

**[0031]** The object information store **322** may be configured to store tracked object data **324**, including but not limited to identity and state information for tracked objects. The object information store **322** also may store untracked object data **326** in embodiments that adaptively learn user patterns and automatically designate objects as tracked, wherein the term "untracked" indicates that state information is not stored for such objects. The untracked object data **326** is illustrated as storing information on a plurality of untracked objects, illustrated as object **1 328** and object **N 332**. Any suitable untracked object data may be stored. For example, importance score information **330** may be stored for each untracked object, wherein the importance score information **330** may be assigned to a recognized object based upon user interactions with the object and then used to determine whether to track the state of an object. When the importance score exceeds a threshold importance score, the object may be designed as a tracked object, and state information may be stored for the object.